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FIG. 1

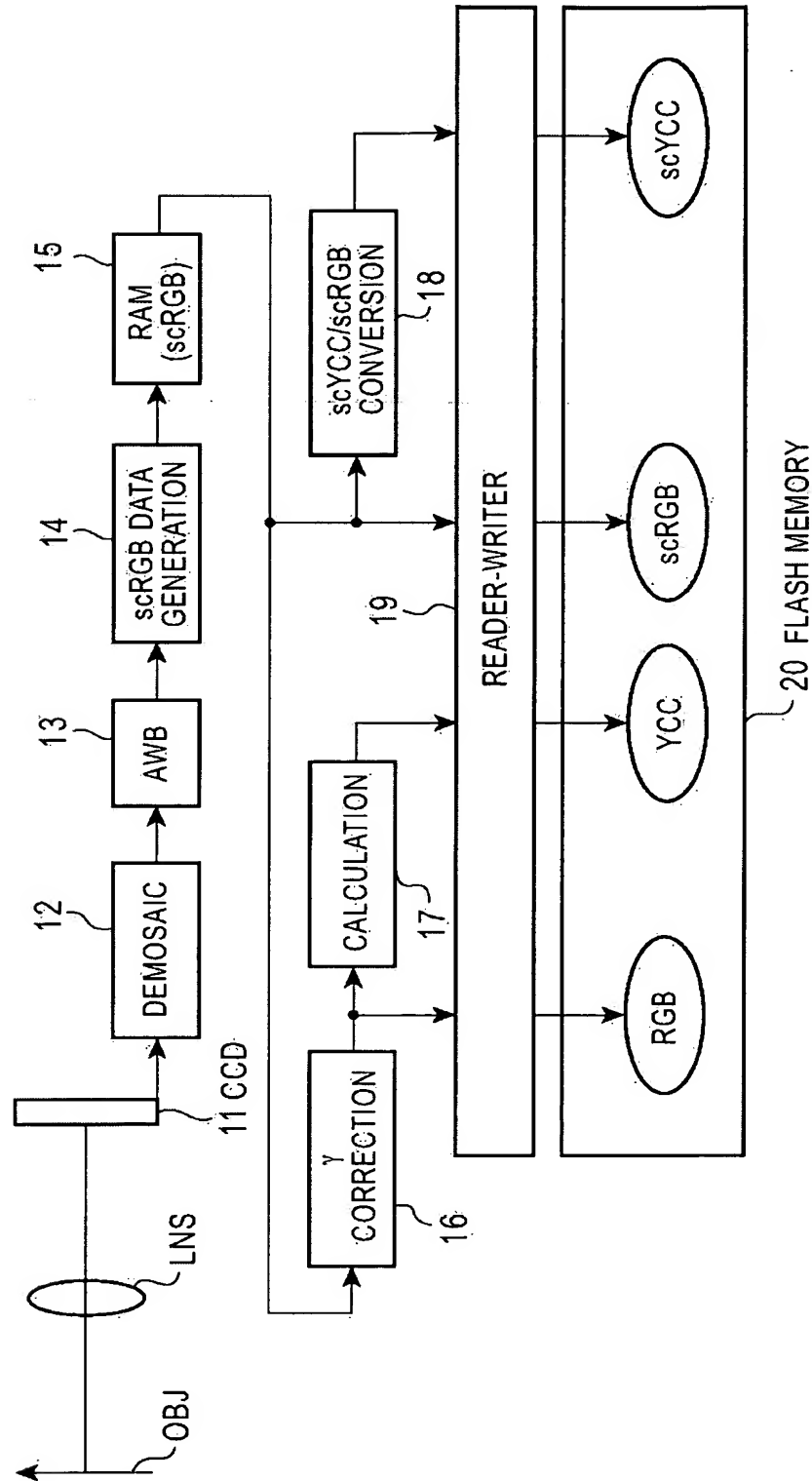
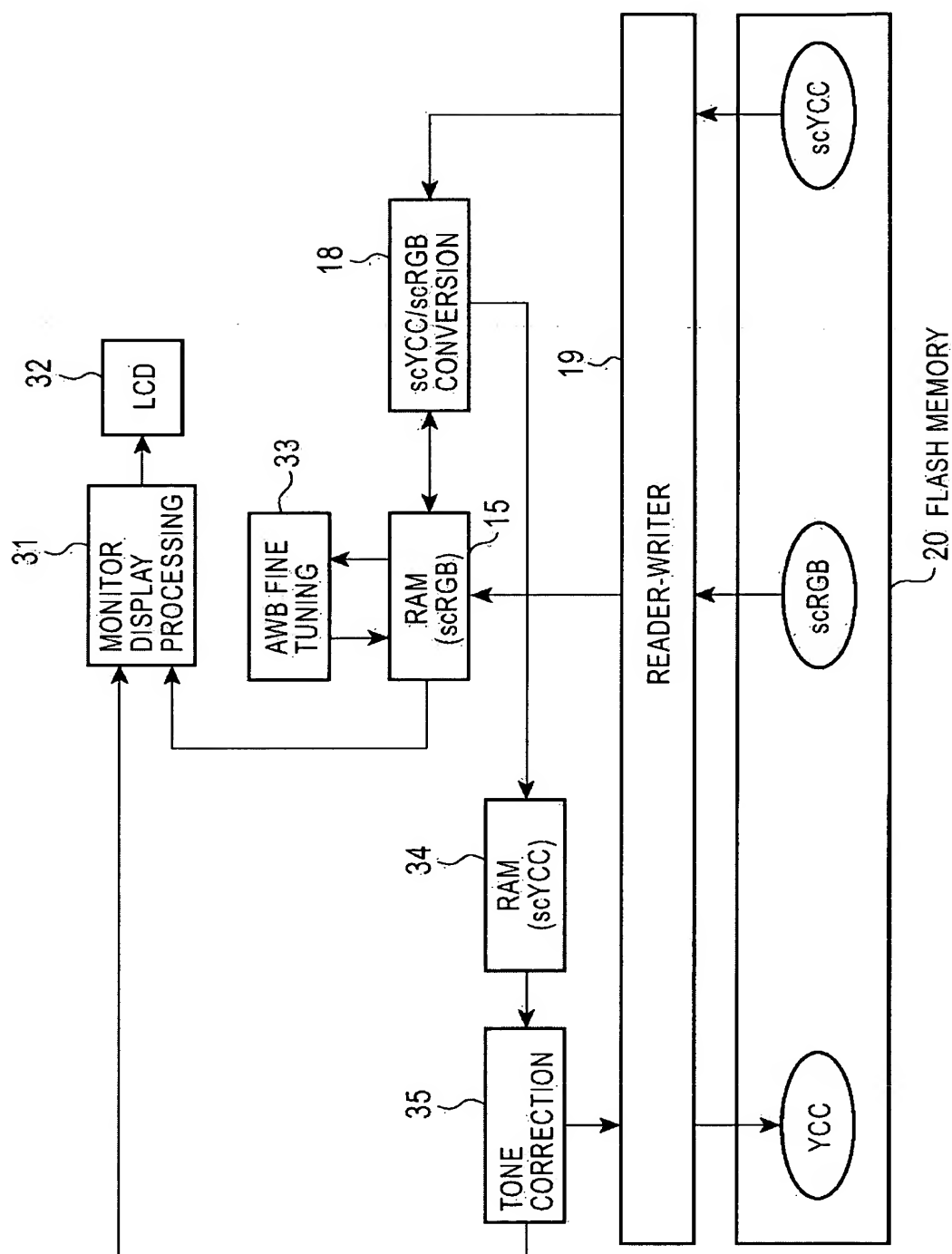


FIG. 2



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FIG. 3

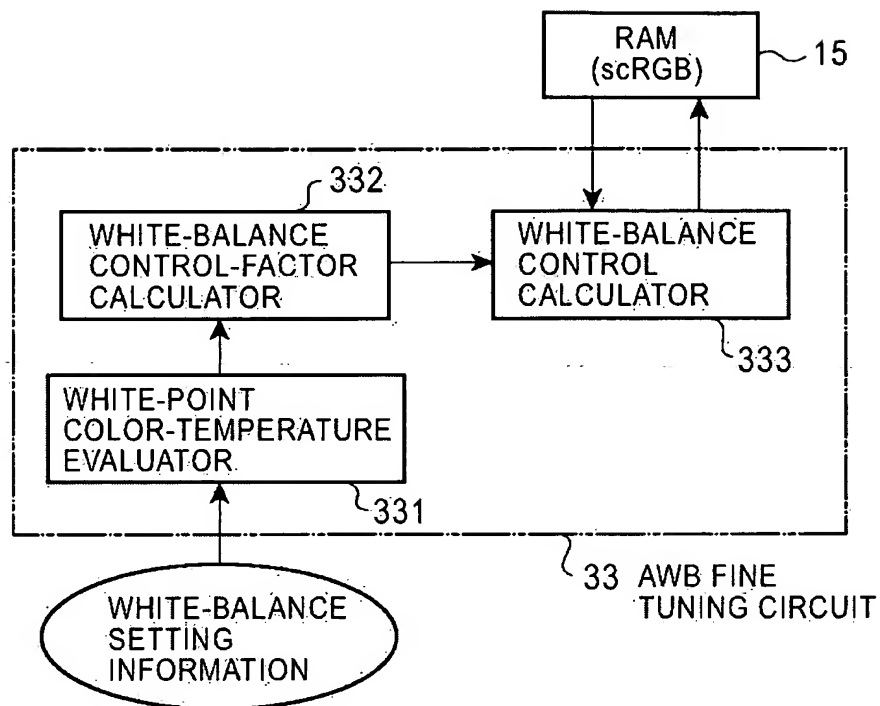


FIG. 4

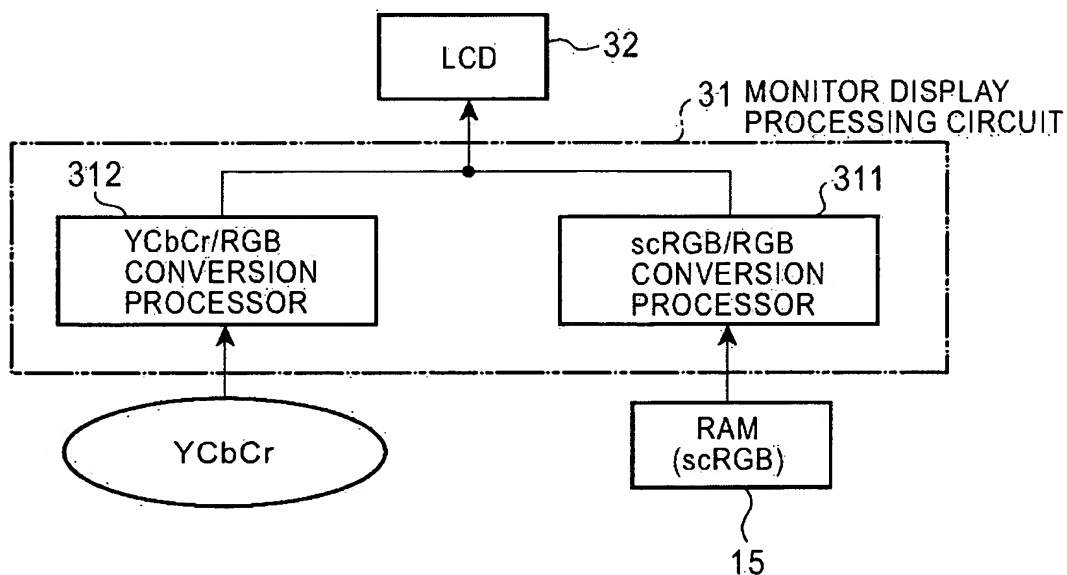


FIG. 5B

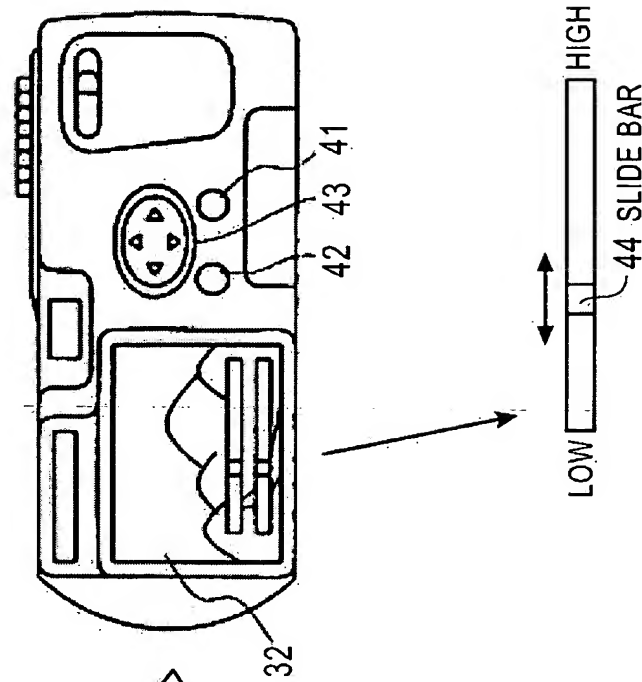
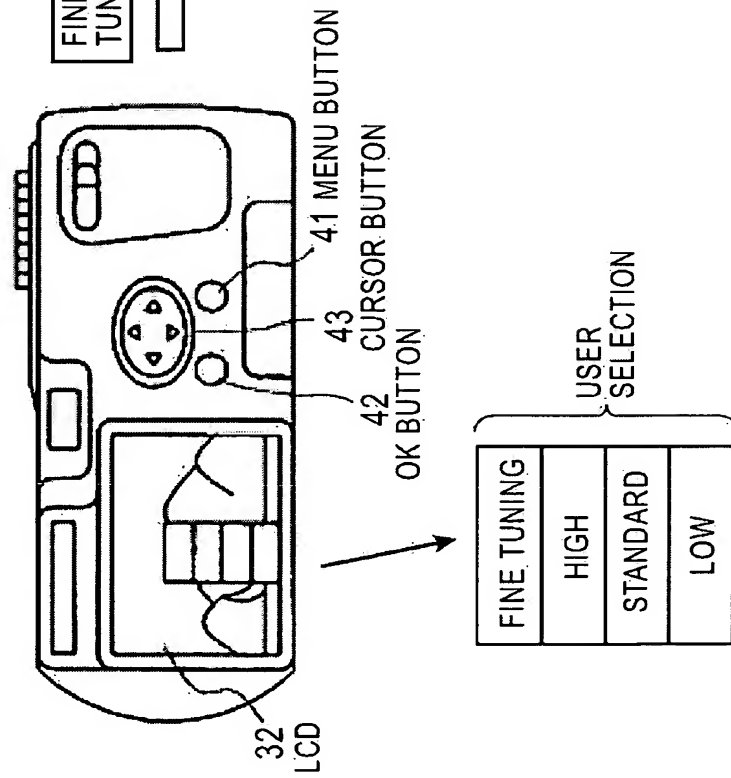


FIG. 5A



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FIG. 6A

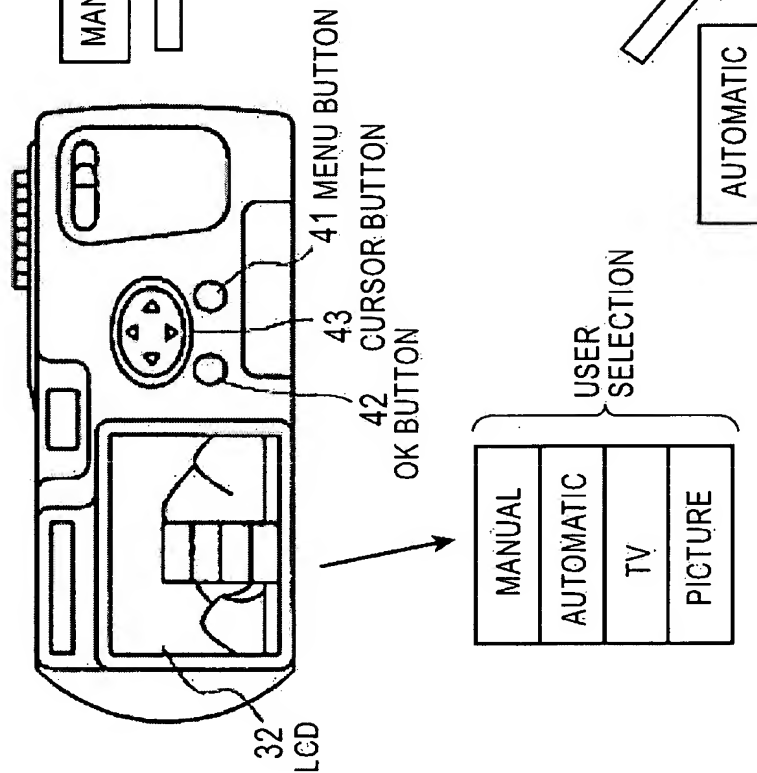


FIG. 6B

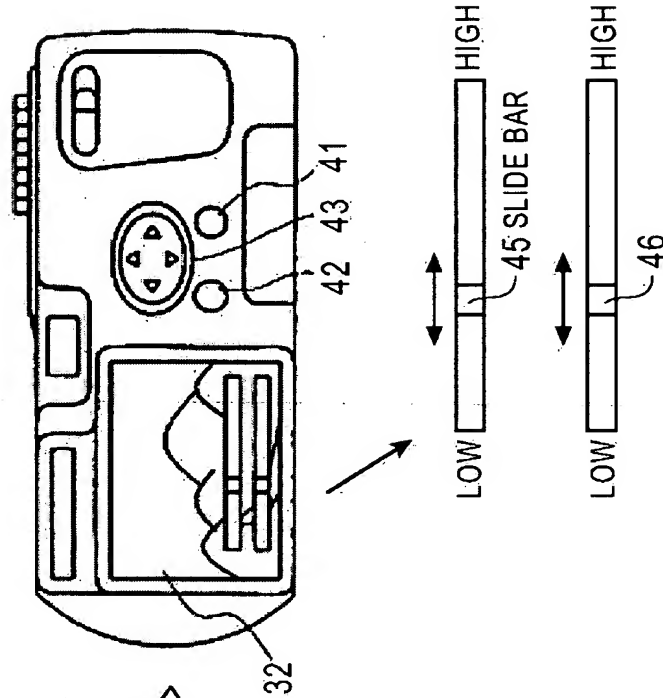
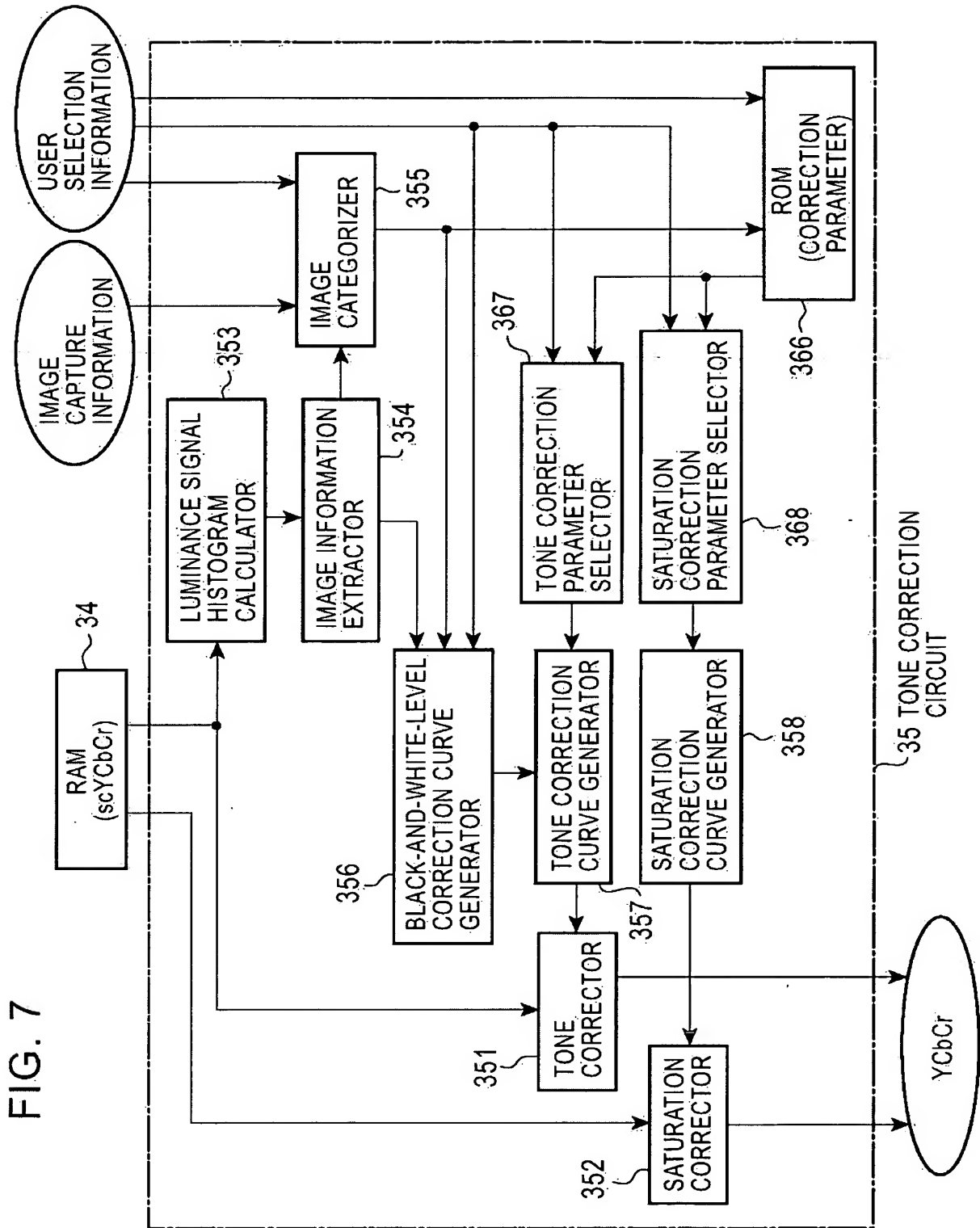


FIG. 6C

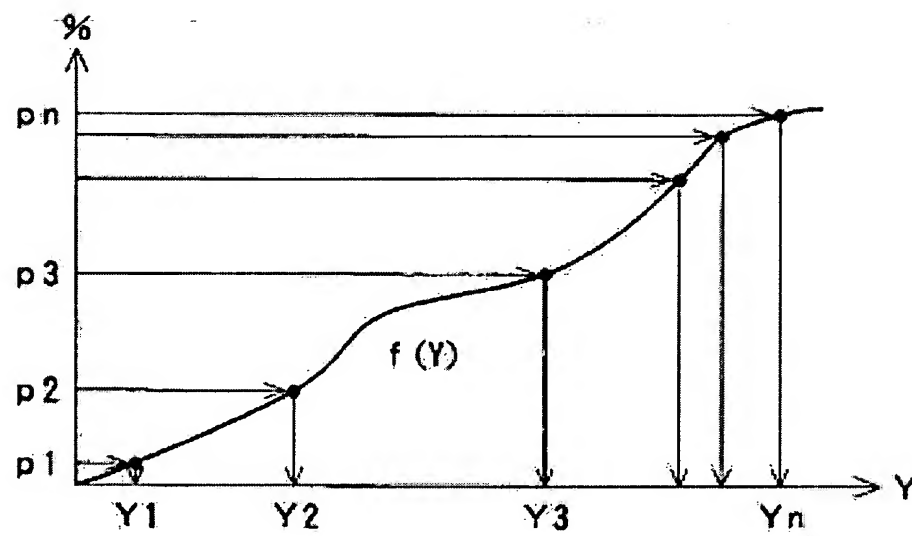
STANDARD
NIGHTSCAPE
SNOWSCAPE

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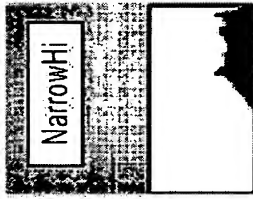

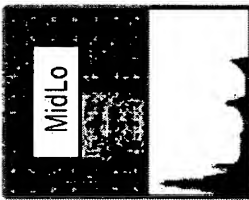

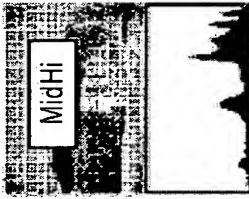
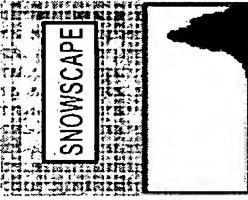
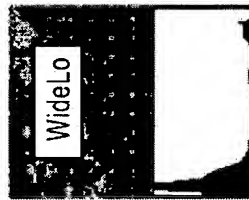


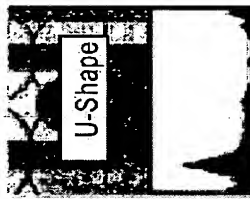
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FIG. 8

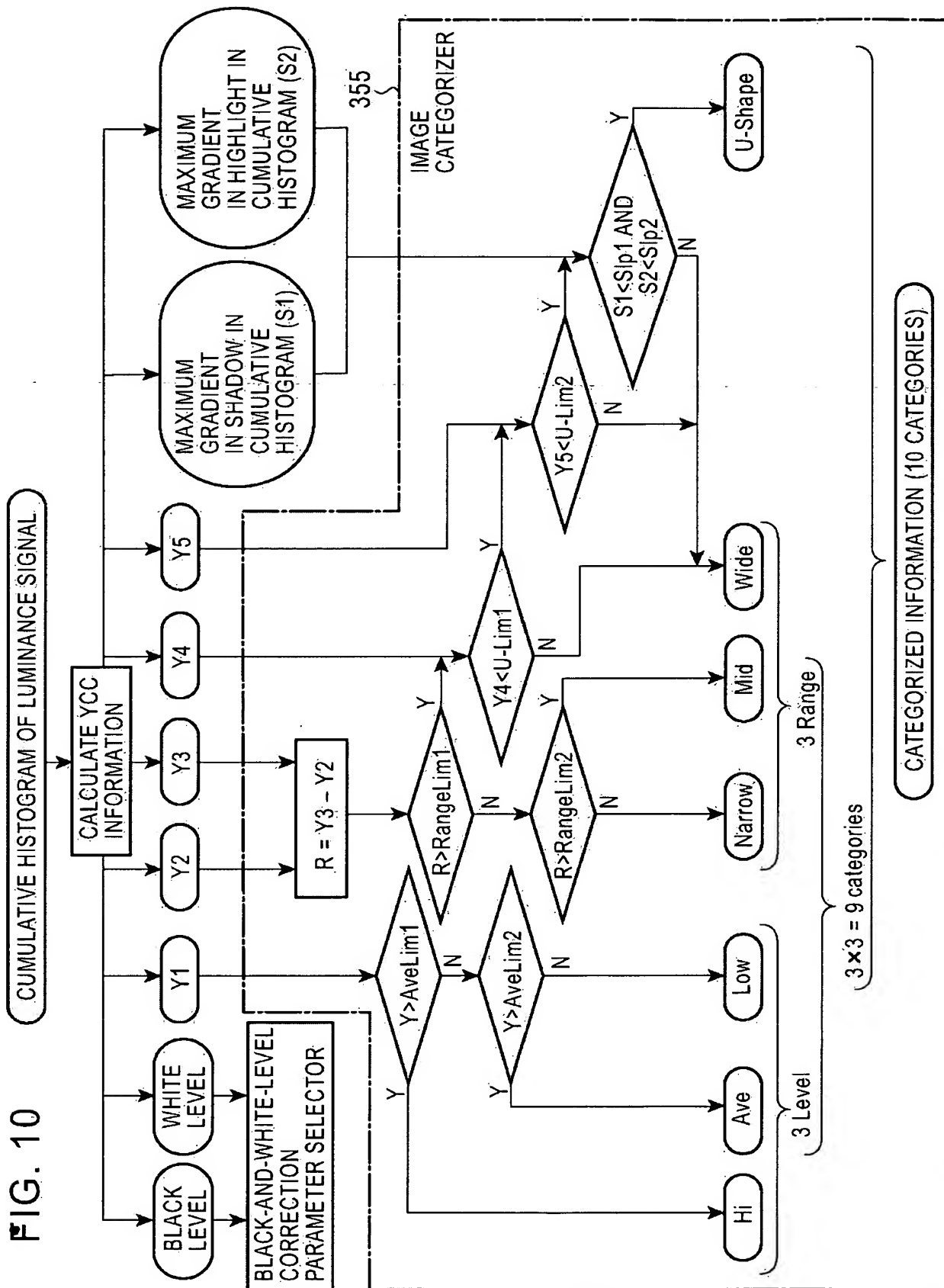


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FIG. 9

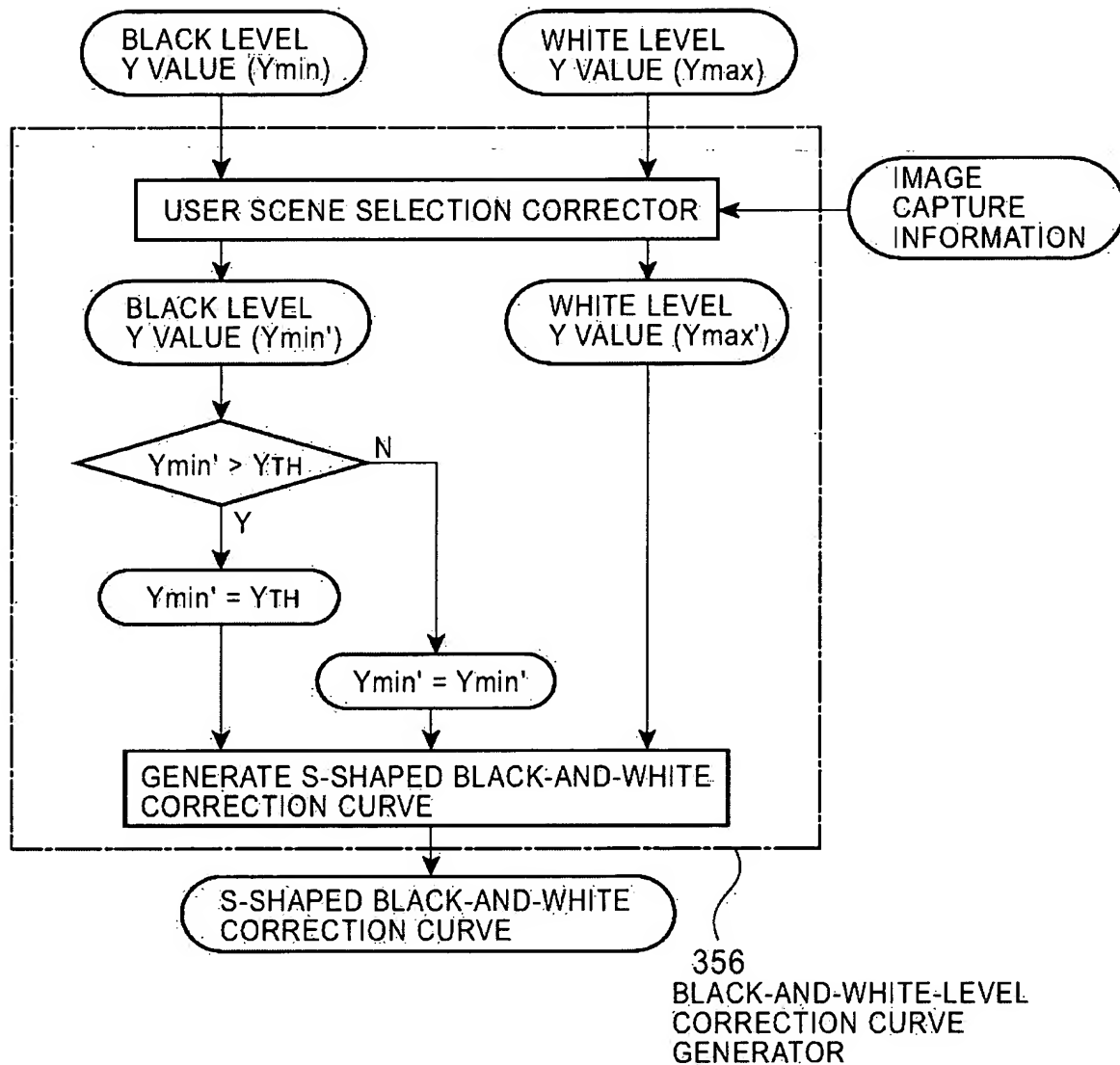
IMAGE CATEGORY RESULTING FROM STATISTICAL ANALYSIS OF IMAGE		AVERAGE OF LUMINANCE SIGNAL Y			IMAGE CATEGORY BASED ON INFORMATION ON IMAGE SCENE
		DARK	AVERAGE	BRIGHT	
RANGE OF HISTOGRAM OF LUMINANCE SIGNAL Y	NARROW				
	MIDDLE				
	WIDE				

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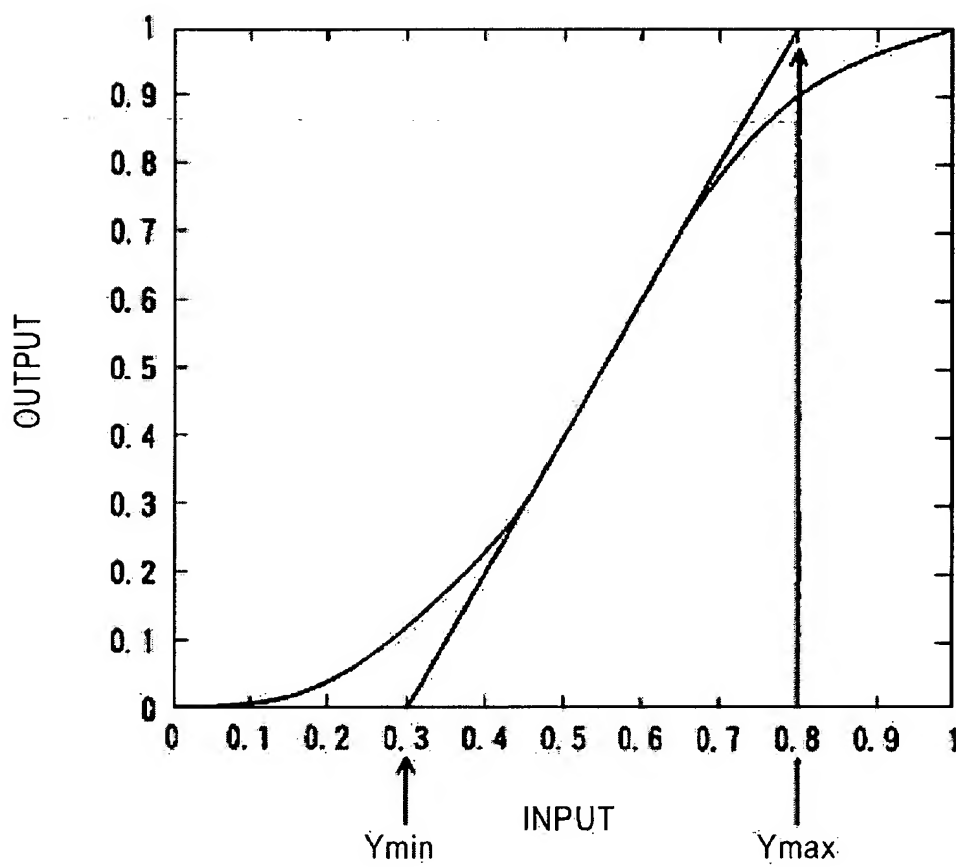
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FIG. 11



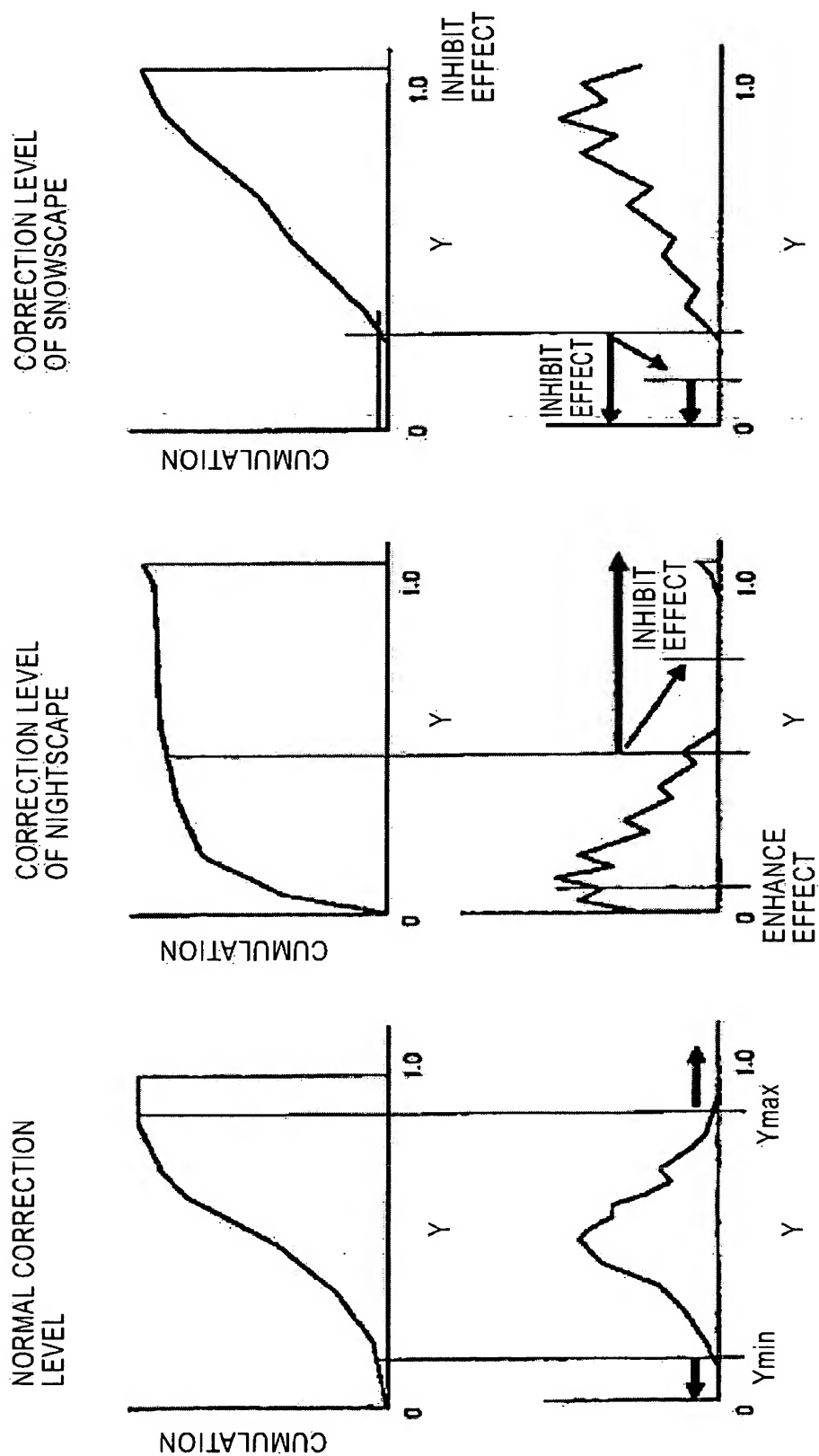
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FIG. 12



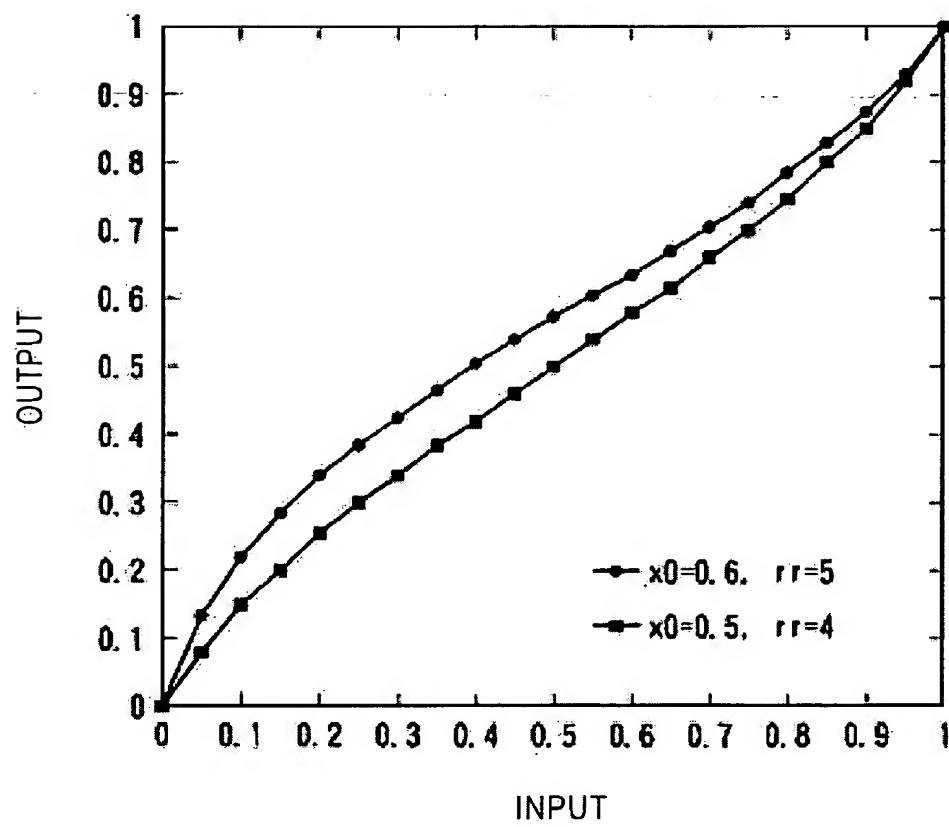
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FIG. 13



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FIG. 14



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FIG. 15

	TONE CORRECTION PARAMETER		SATURATION CORRECTION PARAMETER
	x 0	r r	k c
Narrow & Low	x 0-NL	r r-NL	k c-NL
Narrow & Ave	x 0-NA	r r-NA	k c-NA
Narrow & Hi	x 0-NH	r r-NH	k c-NH
Mid & Low	x 0-ML	r r-ML	k c-ML
Mid & Ave	x 0-MA	r r-MA	k c-MA
Mid & Hi	x 0-MH	r r-MH	k c-MH
Wide & Low	x 0-WL	r r-WL	k c-WL
Wide & Ave	x 0-WA	r r-WA	k c-WA
Wide & Hi	x 0-WH	r r-WH	k c-WH
U-Shape	x 0-U	r r-U	k c-U
NIGHTSCAPE	x 0-N	r r-N	k c-N
SNOWSCAPE	x 0-S	r r-S	k c-S

FIG. 16

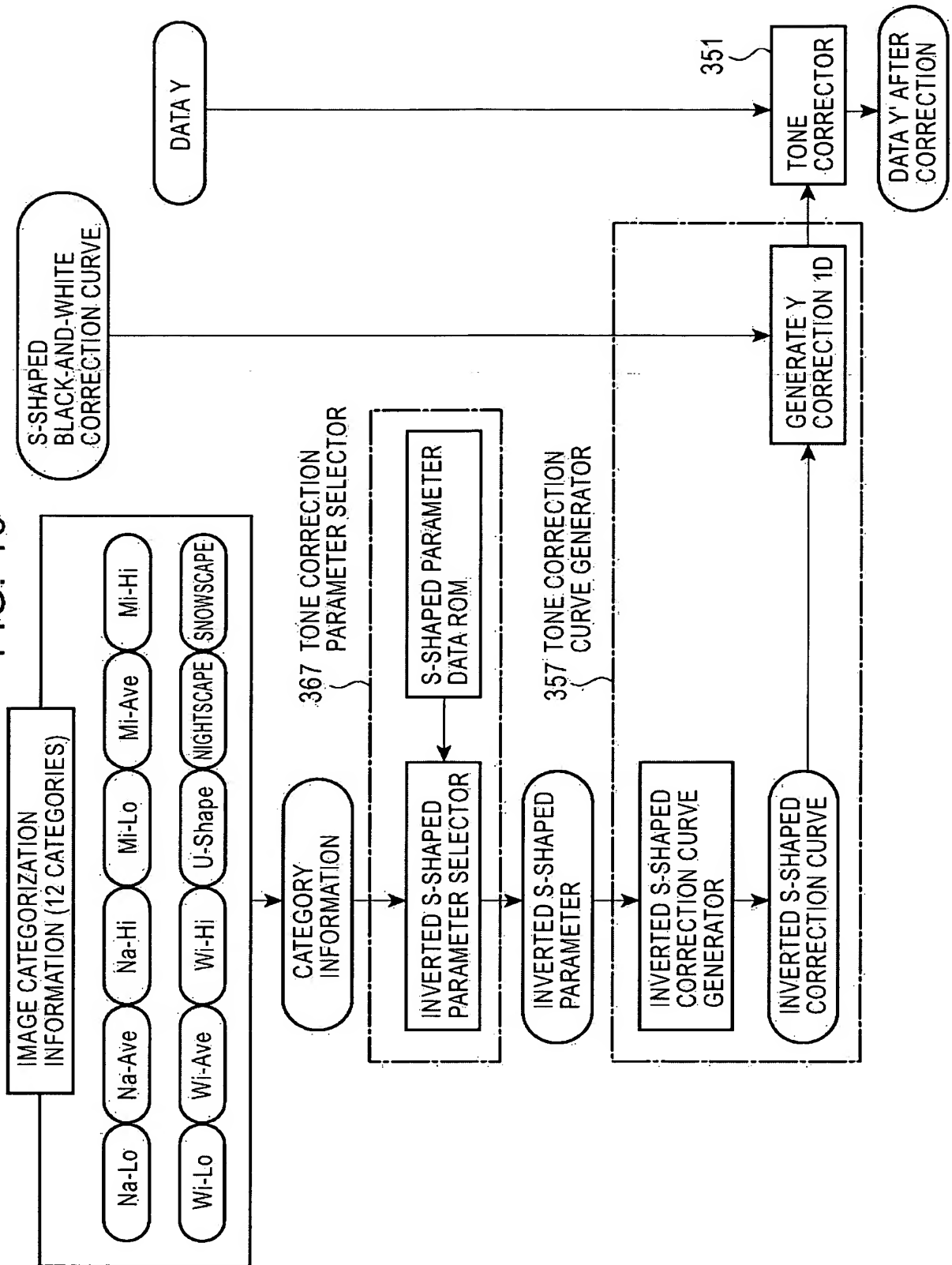
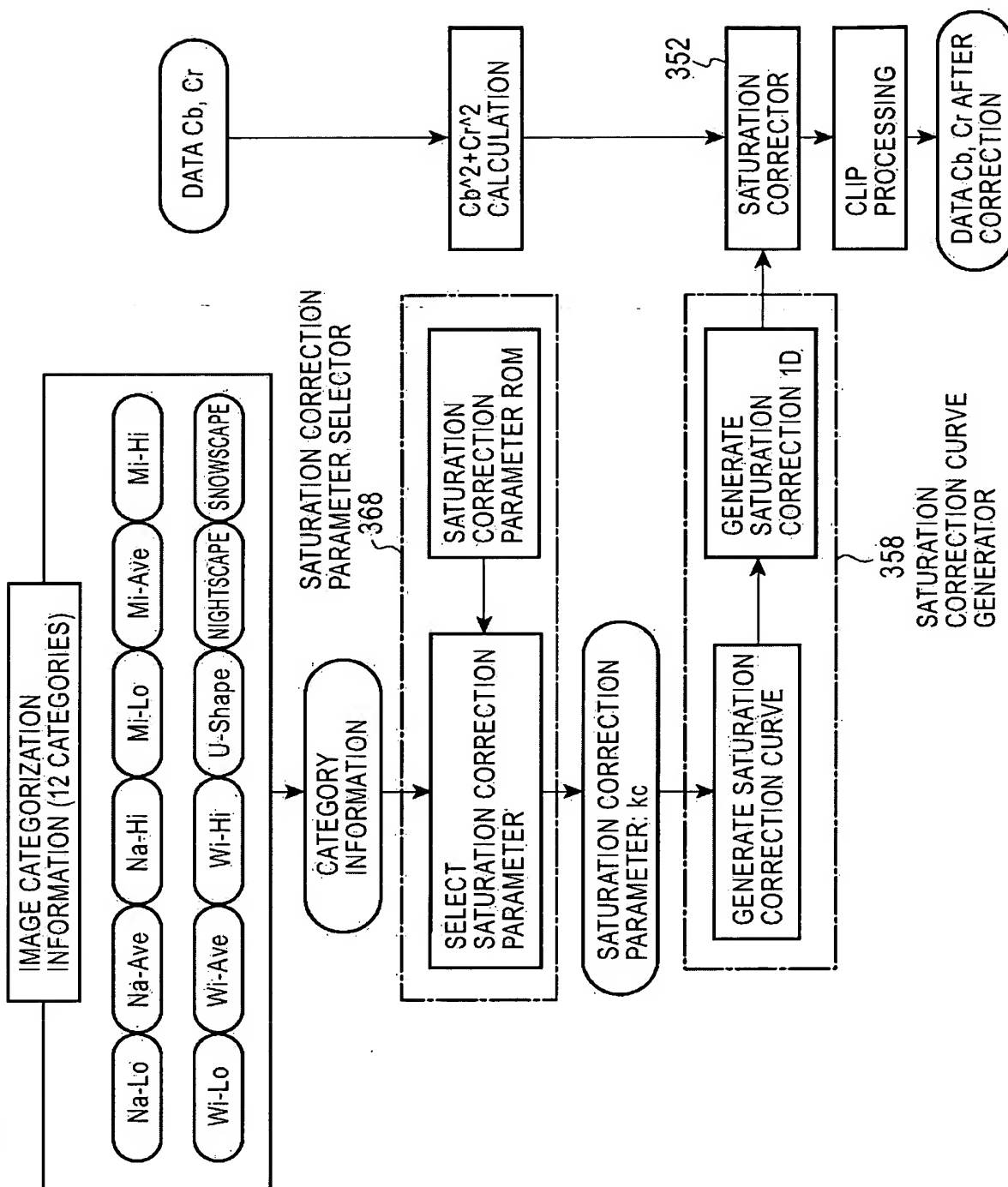


FIG. 17



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FIG. 18

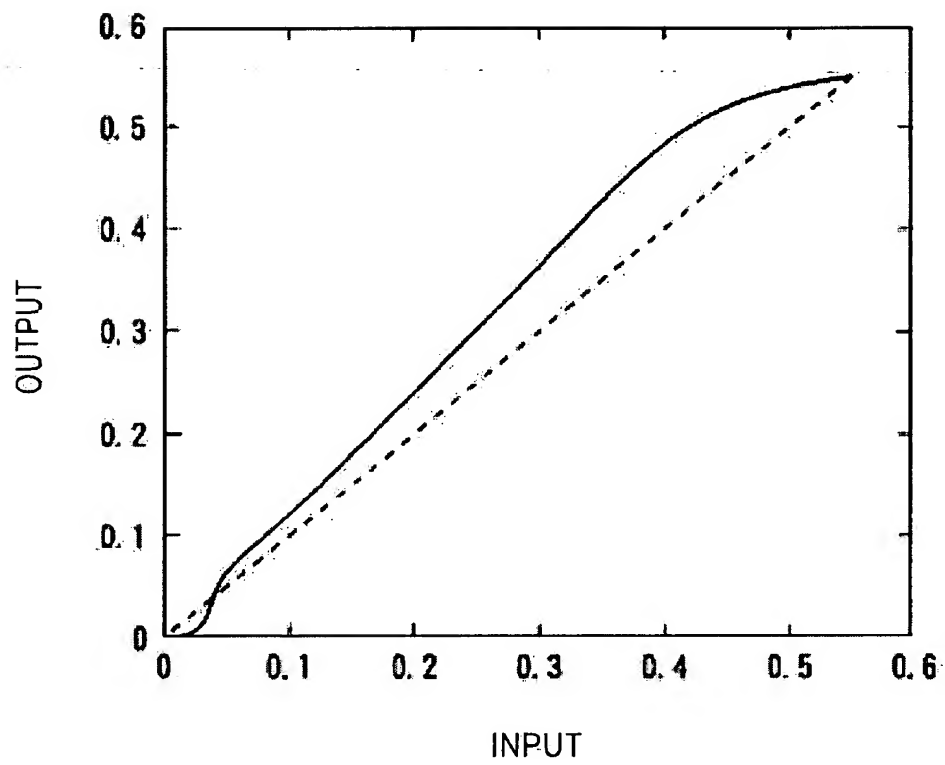


FIG. 19

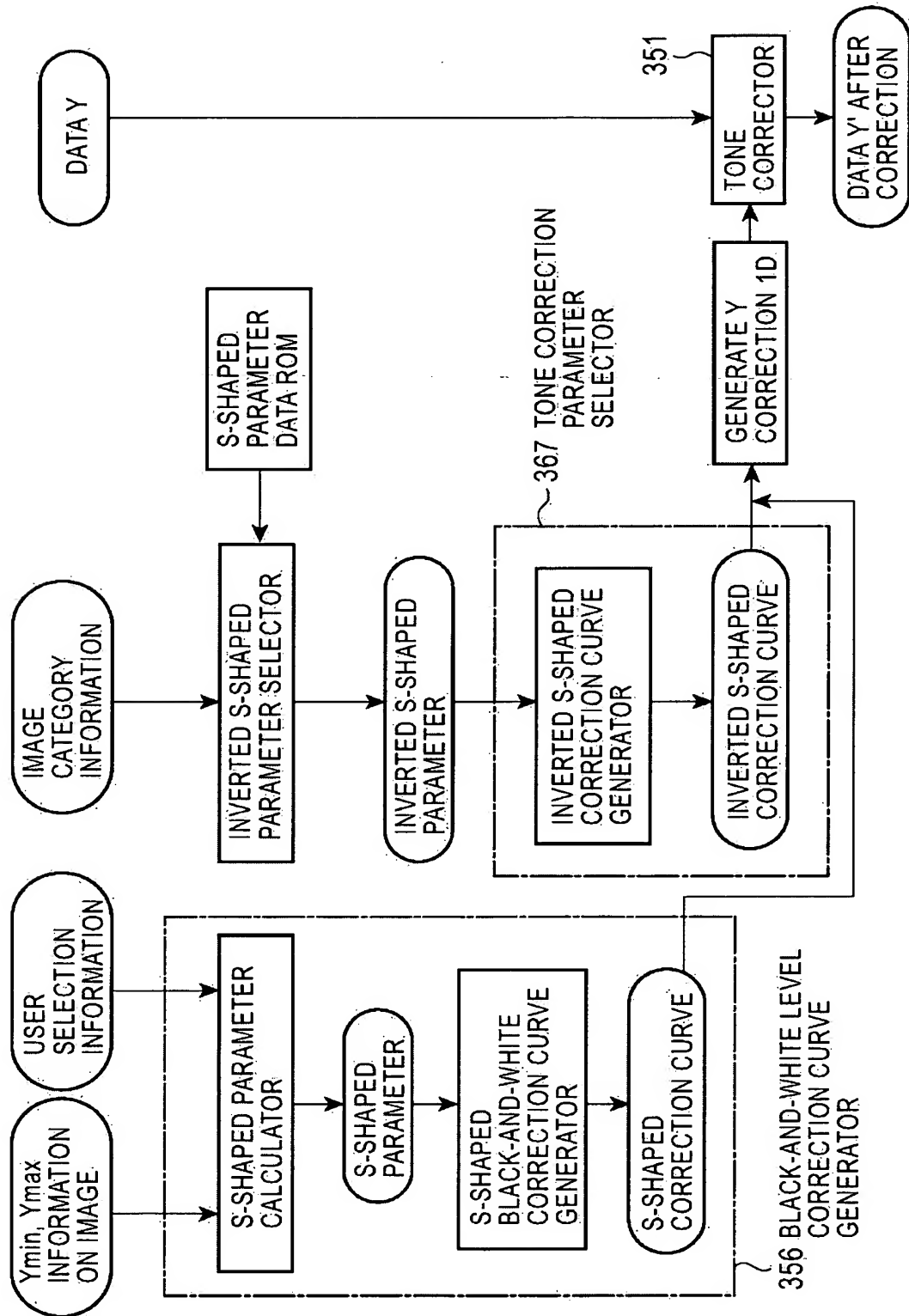


FIG. 20

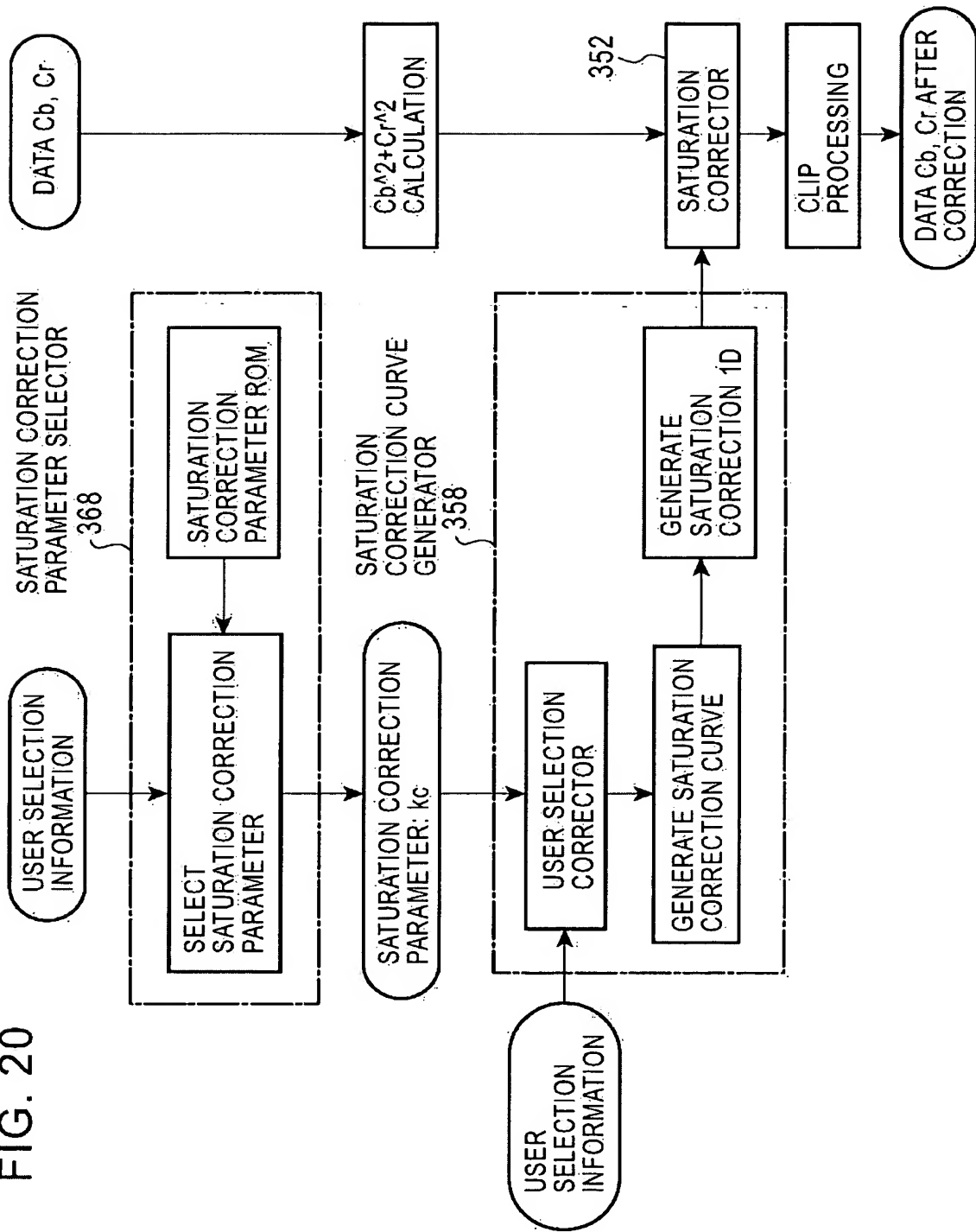


FIG. 21

$$\begin{bmatrix} X_{raw} \\ Y_{raw} \\ Z_{raw} \end{bmatrix} = M1 \cdot \begin{bmatrix} R'2 \\ G'2 \\ B'2 \end{bmatrix} \quad (\text{EQUATION 1})$$

$$M1 = \begin{bmatrix} 0.4124 & 0.3576 & 0.1805 \\ 0.2126 & 0.7152 & 0.0722 \\ 0.0193 & 0.1192 & 0.9505 \end{bmatrix}$$

$$\begin{bmatrix} X_{raw_n} \\ Y_{raw_n} \\ Z_{raw_n} \end{bmatrix} = M2 \cdot \begin{bmatrix} X_{raw} \\ Y_{raw} \\ Z_{raw} \end{bmatrix} \quad (\text{EQUATION 2})$$

WHERE

$$M2 = \begin{bmatrix} 1/(Y_{raw_ave} \times 5) & 0 & 0 \\ 0 & 1/(Y_{raw_ave} \times 5) & 0 \\ 0 & 0 & 1/(Y_{raw_ave} \times 5) \end{bmatrix}$$

$$\begin{bmatrix} R'3 \\ G'3 \\ B'3 \end{bmatrix} = M1^{-1} \cdot \begin{bmatrix} X_{raw_n} \\ Y_{raw_n} \\ Z_{raw_n} \end{bmatrix} \quad (\text{EQUATION 3})$$

$$\begin{cases} R_{scRGB} = \text{round}[(R'3 \times 8192.0) + 4096.0] \\ G_{scRGB} = \text{round}[(G'3 \times 8192.0) + 4096.0] \\ B_{scRGB} = \text{round}[(B'3 \times 8192.0) + 4096.0] \end{cases} \quad (\text{EQUATION 4})$$

$$\begin{cases} R'3 = (R_{scRGB} \div 8192.0) - 0.5 \\ G'3 = (G_{scRGB} \div 8192.0) - 0.5 \\ B'3 = (B_{scRGB} \div 8192.0) - 0.5 \end{cases} \quad (\text{EQUATION 5})$$

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FIG. 22

$$R'_{\text{3}}, G'_{\text{3}}, B'_{\text{3}} \geq 0.0031308$$

$$\begin{cases} R'_{\text{scRGB}} = 1.055 \times R'_{\text{3}}^{(1.0/2.4)} - 0.055 \\ G'_{\text{scRGB}} = 1.055 \times G'_{\text{3}}^{(1.0/2.4)} - 0.055 \\ B'_{\text{scRGB}} = 1.055 \times B'_{\text{3}}^{(1.0/2.4)} - 0.055 \end{cases} \quad (\text{EQUATION 6-a})$$

$$0.0031308 > R'_{\text{3}}, G'_{\text{3}}, B'_{\text{3}} > -0.0031308$$

$$\begin{cases} R'_{\text{scRGB}} = 12.92 \times R'_{\text{3}} \\ G'_{\text{scRGB}} = 12.92 \times G'_{\text{3}} \\ B'_{\text{scRGB}} = 12.92 \times B'_{\text{3}} \end{cases} \quad (\text{EQUATION 6-b})$$

$$R'_{\text{3}}, G'_{\text{3}}, B'_{\text{3}} \leq -0.0031308$$

$$\begin{cases} R'_{\text{scRGB}} = -1.055 \times (-R'_{\text{3}})^{(1.0/2.4)} + 0.055 \\ G'_{\text{scRGB}} = -1.055 \times (-G'_{\text{3}})^{(1.0/2.4)} + 0.055 \\ B'_{\text{scRGB}} = -1.055 \times (-B'_{\text{3}})^{(1.0/2.4)} + 0.055 \end{cases} \quad (\text{EQUATION 6-c})$$

$$\begin{bmatrix} Y'_{\text{scYCC}} \\ C'_{\text{b' scYCC}} \\ C'_{\text{r' scYCC}} \end{bmatrix} = M3 \cdot \begin{bmatrix} R'_{\text{scRGB}} \\ G'_{\text{scRGB}} \\ B'_{\text{scRGB}} \end{bmatrix} \quad (\text{EQUATION 7})$$

WHERE

$$M3 = \begin{bmatrix} 0.2990 & 0.5870 & 0.1140 \\ -0.1687 & -0.3313 & 0.5000 \\ 0.5000 & -0.4187 & -0.0813 \end{bmatrix}$$

$$\begin{cases} Y'_{\text{scYCC}} = \text{round}[(Y'_{\text{scYCC}} \times 1280) + 1024] \\ C'_{\text{b' scYCC}} = \text{round}[(C'_{\text{b' scYCC}} \times 2048) + 1024] \\ C'_{\text{r' scYCC}} = \text{round}[(C'_{\text{r' scYCC}} \times 2048) + 1024] \end{cases} \quad (\text{EQUATION 8})$$

$$T'_{\text{w}} = T_{\text{w}} + \Delta T \quad (\text{EQUATION 9})$$

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FIG. 23

$$\begin{cases} x d' = -4.6070 \times 10^9 / T w'^3 + 2.9678 \times 10^6 / T w'^2 \\ \quad + 0.09911 \times 10^3 / T w' + 0.244063 \\ y d' = -3.000 \times x d'^2 + 2.870 \times x d' - 0.275 \end{cases} \quad (\text{EQUATION 10})$$

$$\begin{cases} X w' = x d' / y d' \\ Y w' = 1 \\ Z w' = (1 - x d' - y d') / y d' \end{cases} \quad (\text{EQUATION 11})$$

$$\begin{bmatrix} R' w \\ G' w \\ B' w \end{bmatrix} = M1^{-1} \cdot \begin{bmatrix} X w' \\ Y w' \\ Z w' \end{bmatrix} \quad (\text{EQUATION 12})$$

$$\begin{cases} k r = R' w / R w \\ k g = G' w / G w \\ k b = B' w / B w \end{cases} \quad (\text{EQUATION 13})$$

$$\begin{cases} R scRGB_{\text{int}} = \text{round}[k r \times R scRGB] \\ G scRGB_{\text{int}} = \text{round}[k g \times G scRGB] \\ B scRGB_{\text{int}} = \text{round}[k b \times B scRGB] \end{cases} \quad (\text{EQUATION 14})$$

$$\begin{cases} Y' scYCC = (Y' scYCC - 1024) / 1280 \\ C b' scYCC = (C b' scYCC - 2048) / 1280 \\ C r' scYCC = (C r' scYCC - 2048) / 1280 \end{cases} \quad (\text{EQUATION 15})$$

$$\begin{bmatrix} R' scRGB \\ G' scRGB \\ B' scRGB \end{bmatrix} = M3^{-1} \cdot \begin{bmatrix} Y' scYCC \\ C b' scYCC \\ C r' scYCC \end{bmatrix} \quad (\text{EQUATION 16})$$

FIG. 24

$R'_{scRGB}, G'_{scRGB}, B'_{scRGB} \geq 0.04045$

$$\begin{cases} R'_3 = \left[\frac{R'_{scRGB} + 0.055}{1.055} \right]^{2.4} \\ G'_3 = \left[\frac{G'_{scRGB} + 0.055}{1.055} \right]^{2.4} \\ B'_3 = \left[\frac{B'_{scRGB} + 0.055}{1.055} \right]^{2.4} \end{cases} \quad (\text{EQUATION 17-a})$$

$0.04045 > R'_3, G'_3, B'_3 > -0.04045$

$$\begin{cases} R'_3 = R'_{scRGB}/12.92 \\ G'_3 = G'_{scRGB}/12.92 \\ B'_3 = B'_{scRGB}/12.92 \end{cases} \quad (\text{EQUATION 17-b})$$

$R'_3, G'_3, B'_3 \leq -0.04045$

$$\begin{cases} R'_3 = - \left[\frac{(-R'_{scRGB}) + 0.055}{1.055} \right]^{2.4} \\ G'_3 = - \left[\frac{(-G'_{scRGB}) + 0.055}{1.055} \right]^{2.4} \\ B'_3 = - \left[\frac{(-B'_{scRGB}) + 0.055}{1.055} \right]^{2.4} \end{cases} \quad (\text{EQUATION 17-c})$$

FIG. 25

$$R' \text{ scRGB}, G' \text{ scRGB}, B' \text{ scRGB} < 0$$

$$\begin{cases} R=0 \\ G=0 \\ B=0 \end{cases} \quad (\text{EQUATION 18-a})$$

$$0 \leq R' \text{ scRGB}, G' \text{ scRGB}, B' \text{ scRGB} \leq 1.0$$

$$\begin{cases} R = \text{round}(R' \text{ scRGB} \times 255) \\ G = \text{round}(G' \text{ scRGB} \times 255) \\ B = \text{round}(B' \text{ scRGB} \times 255) \end{cases} \quad (\text{EQUATION 18-b})$$

$$1.0 < R' \text{ scRGB}, G' \text{ scRGB}, B' \text{ scRGB}$$

$$\begin{cases} R=255 \\ G=255 \\ B=255 \end{cases} \quad (\text{EQUATION 18-c})$$

$$S_{\text{fwd}}(x) = \frac{1}{1 + e^{-rr(x-x_0)}} \quad (\text{EQUATION 19-a})$$

$$Y_{\text{out}} = \frac{S_{\text{fwd}}(Y_{\text{in}}) - S_{\text{fwd}}(0)}{S_{\text{fwd}}(1) - S_{\text{fwd}}(0)} \quad (\text{EQUATION 19-b})$$

$$S_{\text{inv}}(x) = -\frac{1}{rr} \ln \left[\frac{1}{x} - 1 \right] + x_0 \quad (\text{EQUATION 20-a})$$

$$Y_{\text{out}} = \frac{S_{\text{inv}}(Y_{\text{in}}) - S_{\text{inv}}(0)}{S_{\text{inv}}(1) - S_{\text{inv}}(0)} \quad (\text{EQUATION 20-b})$$

$$C_{\text{out}} = k_c \times C_{\text{in}} \quad (\text{EQUATION 21})$$

$$Y_{\text{min_TV}} = Y_{\text{min}} \times B_{K_{\text{tv}}} \quad (\text{EQUATION 22})$$

FIG. 26

$$Y_{\max_TV} = Y_{\max} \times W_{tv} \quad (\text{EQUATION 23})$$

$$k_{c_TV} = k_c \times G_{tv} \quad (\text{EQUATION 24})$$

$$Y_{\max_Pic} = Y_{\max} \times W_{pic} \quad (\text{EQUATION 25})$$

$$k_{c_Pic} = k_c \times G_{pic} \quad (\text{EQUATION 26})$$

$$Y_{\min_User} = Y_{\min} \times B_{Kuser} \quad (\text{EQUATION 27})$$

$$Y_{\max_User} = Y_{\max} \times W_{user} \quad (\text{EQUATION 28})$$

$$k_{c_User} = k_c \times G_{user} \quad (\text{EQUATION 29})$$

$$G_{user} = 2 - \frac{B_{Kuser} + W_{user}}{2} \quad (\text{EQUATION 30})$$

$$\begin{bmatrix} R \\ G \\ B \end{bmatrix} = \begin{bmatrix} 255 & 0 & 0 \\ 0 & 255 & 0 \\ 0 & 0 & 255 \end{bmatrix} \cdot M3^{-1} \cdot \begin{bmatrix} Y' \\ Cb' \\ Cr' \end{bmatrix} \quad (\text{EQUATION 31})$$